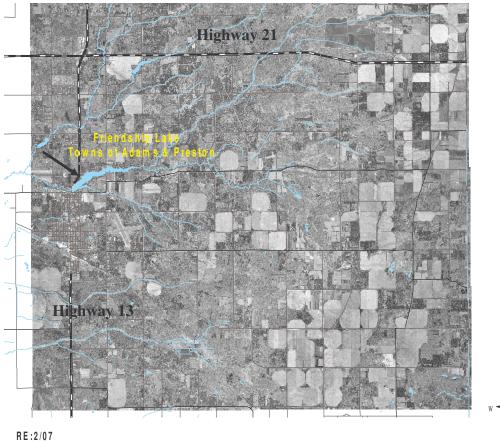
# LAKE CLASSIFICATION SHORT REPORT FRIENDSHIP LAKE, ADAMS COUNTY, WI

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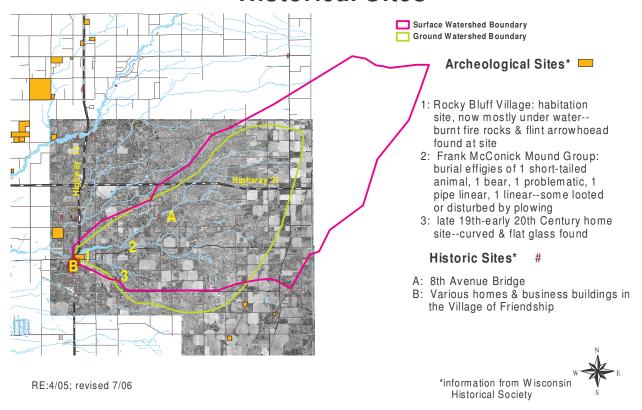
# Introduction

Information about Friendship Lake: Friendship Lake is located in the Towns of Adams and Preston, Adams County, in the south central part of Wisconsin. It is reached off of Highway 13 just north of the Village of Friendship. Friendship Lake is a mesotrophic impoundment with good water quality and good water clarity. It has 115 surface acres, with a maximum depth of 16 feet and an average depth of 6 feet. The lake is created by the damming of Little Roche a Cri Creek and is fed by a large stream system that originates in the next county eastward. The dam is privately owned and has, in the past, generated a small amount of electricity, which was sold to a power company. There is a county-owned park with boat launch and beach located on the northwest end of the lake.





# Friendship Lake Archeological & Historical Sites





**Conical mound** 

There are many Native American archeological sites in Adams County, with three being located right around Friendship Lake. To protect Native American heritage, federal and state laws prohibit further disturbance of these sites without permission of the federal government and input from the local tribes.

There are also a number of historic sites, mostly in the Village of Friendship.



Both the surface and ground watersheds of Friendship Lake are fairly large, extending into the next county east. Studies have shown that lakes are products of their watersheds, with land use around having a great impact on the water quality of that lake, especially in the amount and content of stormwater runoff from the surface. Runoff volume is affected by the amount of impervious surface, the soil type and the slope of the area. Natural landscapes tend to have low stormwater runoff.

Land use acreage and percent of total are shown on the chart below:

	Surface		Ground		Total	
				% of		% of
Friendship Lake	Acres	% of Total	Acres	Total	Acres	Total
AgricultureNon						
Irrigated	1894.16	11.37%	758.03	11.41%	2652.19	11.38%
AgricultureIrrigated	7237.08	43.43%	1929.28	29.04%	9166.36	39.33%
Government	24.97	0.15%	10.63	0.16%	35.6	0.15%
Grassland/Pasture	188.08	1.13%	39.86	0.60%	227.94	0.98%
Residential	1033.63	6.20%	635.12	9.56%	1668.75	7.16%
Water	311.25	1.87%	251.13	3.78%	562.38	2.41%
Woodland	5975.43	35.85%	3019.47	45.45%	8994.9	38.59%
total	16,664.60	100.00%	6643.52	100.00%	23308.12	100.00%

Agriculture (irrigated and non-irrigated) is the largest land use type in the surface watershed for Friendship Lake. Traditionally, agriculture may contribute significantly to nutrient loading in water bodies.

Woodlands are the second largest land use category in the surface watersheds. Since forest floors are often full of leaves, needles and other duff, runoff from forested land is usually more filtered than that from agricultural or residential lands.

The 6600+ acre ground watershed for Friendship Lake, which mostly has irrigated agriculture and woodlands as land use, also contributes to phosphorus loading into the lake.

Over 100 acres of the entire watershed is in residential use, much of which is concentrated near the lake. This land use category may also contribute a significant amount of nutrients to the water from stormwater runoff, mowed lawns, and impervious surfaces.

There are several wetlands in the Friendship Lake watersheds, including several at or just above Friendship Lake's shore. Wetlands play an important role in water quality by trapping many pollutants in runoff waters and by serving as buffers to catch and control what would otherwise be uncontrolled water and pollutants. Wetlands also play an essential role in the aquatic food chain, thus affecting fishery, and also serve as spaces for wildlife habitat, wildlife reproduction & nesting, and wildlife food.

The photo below shows one of the wetlands along at the eastern end of Friendship Lake's shore.



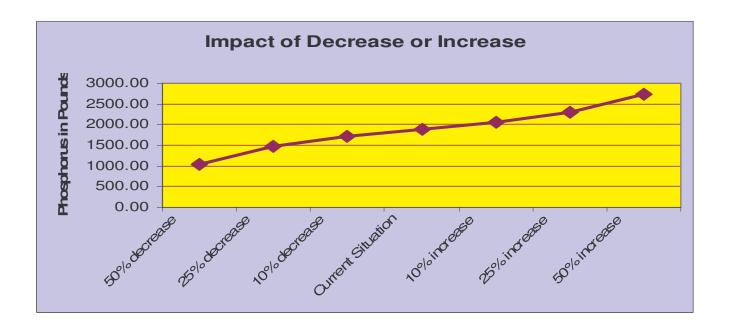
Wetlands along Friendship Lake shore

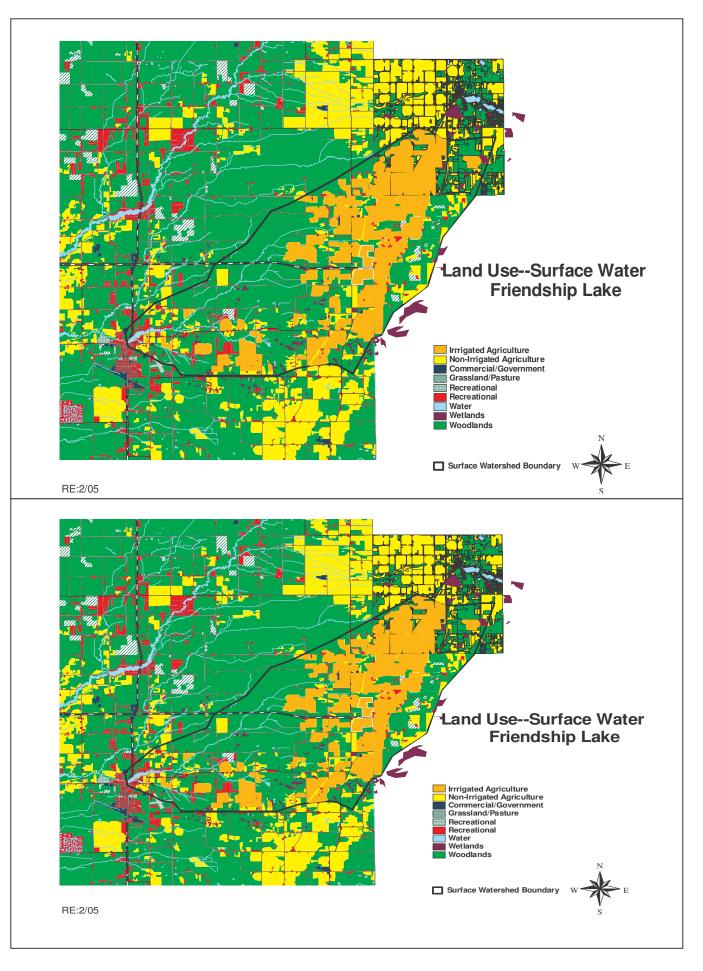
Like many lakes in Wisconsin, Friendship Lake is a phosphorus-limited lake. This means that that of the pollutants that end up in the lake, the one in the shortest supply and most affects the overall quality of the lake water is phosphorus. Land use types play a major role in determining the amount of phosphorus being loaded into the lake.

MOST LIKELY PHOSPHORUS LOADING		
Land Use	% of Total	P in lbs/acre/yr
Irrigated Agriculture	69.2%	1306.18
Non-Irrigated Agriculture	14.5%	273.91
Grassland/Pasture	0.5%	9.81
Residential	1.9%	35.69
Woodlands	5.7%	107.96
Other Water	0.6%	10.71
Ground Watershed	6.4%	119.55
Government/Commercial	0.1%	2.68
Lake Surface	0.3%	6.25
Septics	0.8%	14.72
	100.0%	1887.46

Some aspects of phosphorus loading can't be modified by human behavior—they are simply part of the natural landscape. However, phosphorus loading from agriculture, residential, residential and septic use of the land can be decreased or increased. Simply reducing agricultural, residential and septic use by 10% would result in 169 fewer pounds of phosphorus per acre per year. That may not initially sound like much. However, when it is calculated that one pound of phosphorus can produce up to 500 pounds of phosphorus, that 10% reduction could mean up to 84,495 pounds fewer of algae per acre per year!

	P/lbs/acre/yr
50% decrease	1049.90
25% decrease	1464.68
10% decrease	1718.35
Current Situation	1887.46
10% increase	2056.57
25% increase	2310.24
50% increase	2733.02



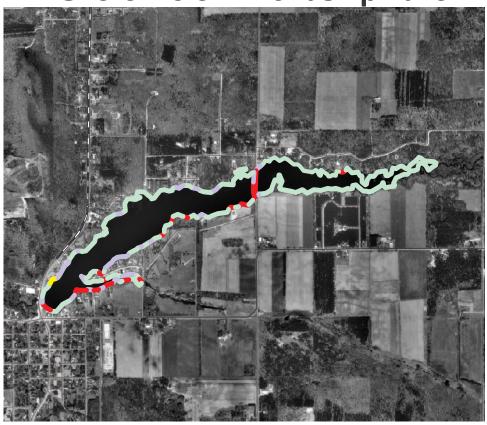


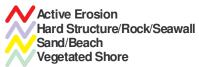
# Shorelands

Friendship Lake has a total shoreline of 5.9 miles (31,152 feet). Much of the lakeshore is in residential use. Many of the areas near the shore are steeply sloped, except at the far northwest end, where the land is flatter and where the beach and boat launch are located.

A 2004 shore survey revealed that 75.8% of Friendship Lake's shoreline is vegetated. The rest of the shore is a mix of sand, rock and/or other hard structure. Several areas also have significant erosion occurring, noted in red on the map below.

## **Shoreline on Friendship Lake**





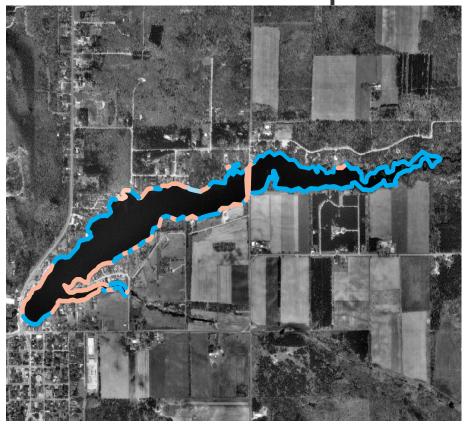


RE:4/05

However; the shore survey showed that less than one-half of the shore had an "adequate buffer." An "adequate buffer" is a native vegetation strip at least 35 feet landward from the shore.

Most of the "inadequate" buffer areas were those with sand, mowed lawns, hard structure and/or insufficient native vegetation at the shoreline to cover 35 feet landward from the water line.

**Buffers on Friendship Lake** 





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Some of Friendship Lake's steep shores



Shoreland buffers are important part of lake protection and restoration. These buffers are simply a wide border of native plants, grasses, shrubs and trees that filter and trap soil & similar sediments, fertilizer, grass clippings, stormwater runoff and other potential pollutants, keeping them out of the lake. A 1990 study by the Wisconsin Department of Natural Resources of Wisconsin shorelines revealed that a buffer of native vegetation traps 5 to 18 times more volume of potential pollutants than does a developed, traditional lawn or hard-armored shore. The filtering process and bank stabilization that buffers provide help improve a lake's water quality, including water clarity.



**Example of Adequate Buffer** 



**Example of Inadequate Buffer** 

Vegetated shoreland buffers help stabilize shoreline banks, thus reducing bank erosion. The plant roots give structure to the bank and also increase water infiltration and decrease runoff. A vegetated shore is especially important when shores are steep and sandy, as are many of the Friendship Lake shores.

# Water Quality Information

One of the measures Wisconsin uses to give a general estimate of a lake's water quality is the **trophic state index**. This index looks at a lake's water clarity, its amount of total phosphorus (the element most related to aquatic plant and algal growth), and its chlorophyll-a level (chlorophyll-a is a pigment used by algae for photosynthesis).

Depending on the trophic index score, lakes are then classified as **Oligotrophic** (good), **Mesotrophic** (fair), or **Eutrophic** (poor):

- Good: Oligotrophic lakes have clear, deep water with few algal blooms. Larger game fish are often found in such lakes.
- Fair: Mesotrophic lakes have more aquatic plant and algae production, with occasional algal blooms and a good fishery. The water is usually not as clear as that of oligotrophic lakes.
- **Poor:** Eutrophic lakes are very productive, with lots of aquatic plants and algae. Algal blooms are often frequent in these lakes. They may have a diverse fishery, but rough fish (such as carp) are also common. Water is often cloudy or murky. Small shallow lakes are more likely to be eutrophic.

	Score	TSI Level Description
T	30-40	Oligotrophic: clear, deep water; possible oxygen depletion in lower depths; few aquatic plants or algal blooms; low in nutrients; large game fish usual fishery
Friend- ship Lake's	40-50 <b>→</b>	Mesotrophic: moderately clear water; mixed fishery, esp. panfish; moderate aquatic plant growth and occasional algal blooms; may have low oxygen levels near bottom in summer
overall TSI is 48	50-60	Mildly Eutrophic: decreased water clarity; anoxic near bottom; may have heavy algal bloom and plant growth; high in nutrients; shallow eutrophic lakes may have winterkill of fish; rough fish common
	60-70	<b>Eutrophic:</b> dominated by blue-green algae; algae scums common; prolific aquatic plant growth; high nutrient levels; rough fish common; susceptible to oxygen depletion and winter fishkill
	70-80	Hypereutrophic: heavy algal blooms through most of summer; dense aquatic plant growth; poor water clarity; high nutrient levels



Water clarity readings are usually taken by using a Secchi disk (shown at right). Average summer Secchi disk clarity in Friendship Lake in 2004-2006 was 6.52 feet. The average for 1992 -2002 was 5.54 feet, slightly lower than the current average, but still putting Friendship Lake's water clarity in the "good" clarity category. Water clarity can be reduced by turbidity (suspended materials such as algae and silt) and dissolved organic chemicals that color or cloud the water.

Increased phosphorus levels in a lake will feed algal blooms and also may cause excess plant growth. **The 2004-2006 summer average phosphorus concentration in Friendship Lake was 27.7 micrograms/liter.** This is in the "good" category for total phosphorus levels and slightly below the 1992-2002 average of 30.2 micrograms/liter. However, these levels are high enough that algal blooms may occur with some frequency.





The third measure used in trophic state classification is the amount of chlorophyll-a contained in the lake. The amount of chlorophyll-a found in a lake is an indication about the amount of algae in the lake. The 2004-2006 summer average chlorophyll-a concentration in Friendship Lake was 11.5 micrograms/liter. This level of chlorophyll-a gives Friendship Lake a "fair" ranking for chlorophyll-a and is similar to the 11 micrograms/liter for 1992-2002.

# In-Lake Habitat

### **Aquatic Plants**

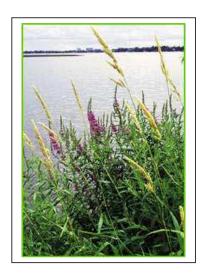
A diverse aquatic plant community plays a vital role in improving water quality, providing valuable habitat resources for fish and wildlife, resisting invasions of non-native species and checking excessive growth of the most tolerant species.

An updated aquatic plant survey was performed in 2006. The 0-1.5ft depth zone supported the most abundant aquatic plant growth. The Friendship Lake aquatic plant community is characterized by good quality and very good species diversity. The most species found in 2006 were common Ceratophyllum demersum (coontail), Lemna minor (small duckweed), Vallisneria americana (water celery) and Wolffia columbiana Important to maintaining a (watermeal). quality, diverse aquatic plant community is an integrated aquatic plant management plant that controls the invasive plants in the lake. The invasive exotics currently in Friendship Lake include Myriophyllum spicatum (Eurasian watermilfoil), Phalaris arundinacea (reed canary grass), and Potamogeton crispus (curly-leaf pondweed). The latter two occur at more than average density where they are present. Monitoring for all of these on an ongoing basis is necessary to keep them from dominating the aquatic community.

More detailed information can be found in the aquatic plant report of the 2006 survey, available on request from the WDNR or Adams County Land & Water Conservation Department.



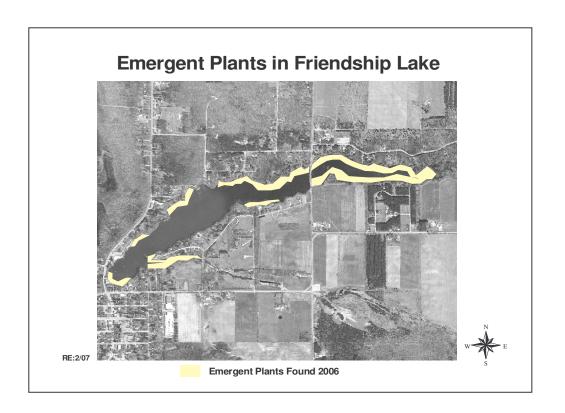
**Curly-Leaf Pondweed** 

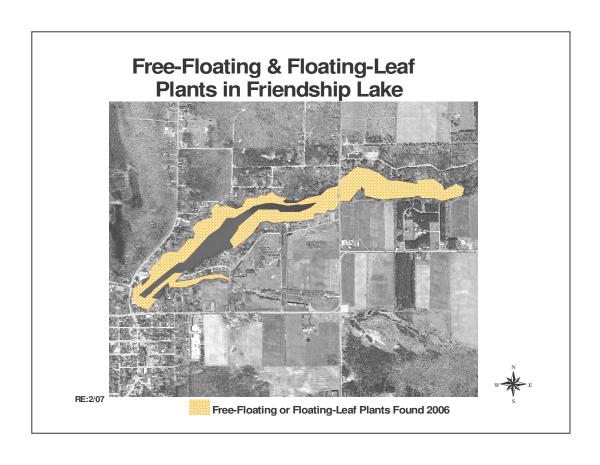


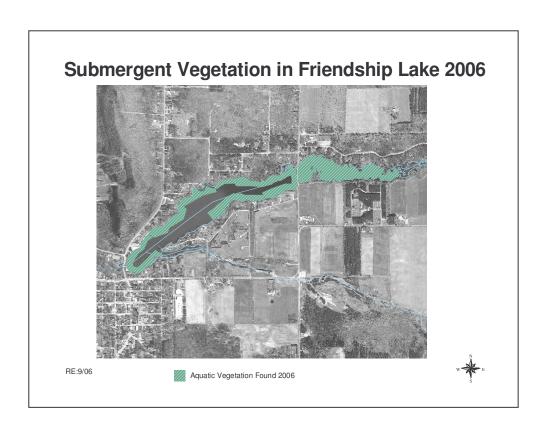
Reed Canary Grass & Purple Loosestrife

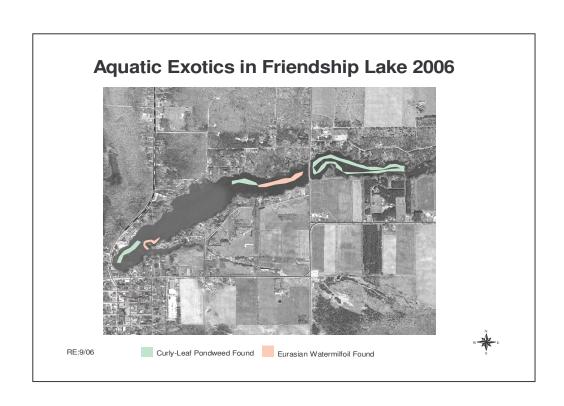


**Eurasian Watermilfoil** 



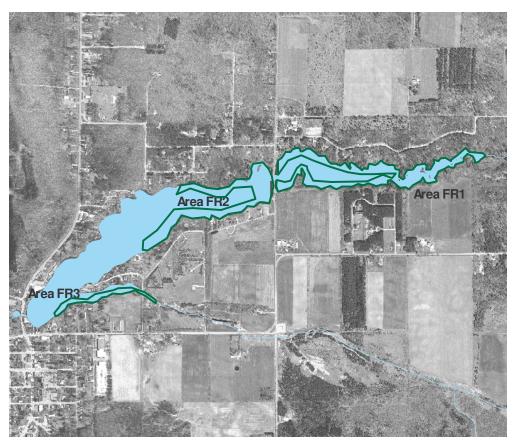






### **Critical Habitat**

### Critical Habitat Areas--Friendship Lake



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Wisconsin Rule 107.05(3)(i)(I) defines a "critical habitat areas" as: "areas of aquatic vegetation identified by the department as offering critical or unique fish & wildlife habitat or offering water quality or erosion control benefits to the body of water. Thus, these sites are essential to support the wildlife and fish communities. They also provide mechanisms for protecting water quality within the lake, often containing high-quality plant beds. Finally, critical habitat areas often can provide the peace, serenity and beauty that draw many people to lakes in the first place.

Three areas on Friendship Lake were determined to be appropriate for critical habitat designation. FR1 extends along approximately 6000 feet of the eastern shoreline (both sides) of Friendship Lake, up to the ordinary high water mark. FR2 extends along approximately 5000 feet of the north and south shoreline in the middle of the lake's length. FR3 covers 2100 of the southwestern lake shore.





Photo of part of Area FR1

**Photo of Part of FR2** 

The Critical Habitat Report for Friendship Lake has more specific information on these sites. Copies are available from the Adams County Land & Water Conservation Department.

# Fishery/Wildlife/Endangered Resources

WDNR fish stocking records for Friendship Lake go back to 1933, when walleye and black bass were stocked. Through the next 25 years, stocking occurred frequently, generally concentrating on largemouth & smallmouth bass, bluegills, perch, walleye and northern pike. There was a fish removal in 1984 that revealed that there were about four times more bluegills than all the other fish found put together. The most recent inventory, done in 2002, found that largemouth bass and bluegills were abundant, yellow perch and white sucker were scarce, and pumpkinseed and black crappie were present. Carp have also been found in the lake in the past.

Muskrat and mink are also known to use Friendship Lake shores for cover, reproduction and feeding. Seen during the field survey were various types of waterfowl, songbirds, and turkey. Frogs and salamanders are known, using the lake shores for shelter/cover, nesting and feeding. Turtles and snakes also use this area for cover or shelter in this area, as well as nested and fed in this area. Upland wildlife feed and nest here as well.

Many endangered resources are found in the Friendship Lake watersheds. Natural communities known to be present include alder thicket, central poor fen, floodplain forest, northern dry forest, northern sedge meadow, oak barrens, pine barrens, sand barrens, shrub-carr and stream (fast, hard, cold). Endangered birds found are Greater Prairie Chicken and Red-Shouldered Hawk. Invertebrates of concern include Karner Blue Butterfly, Persius Dusky Wing Butterfly, and Sand Snaketail dragonfly. Several endangered plants—Crossleaf Milkwort, Slim-Stem Small Reedgrass, Whip Nutrush—are also present.



**Greater Prairie Chicken** 

### Karner Blue Butterflhy





**Crossleaf Milkwort** 

# Recommendations

#### Lake Management Plan

• When the lake management plan is next reviewed, the District needs to make sure that it includes at least the following aspects concerning the management of the lake: aquatic species management; control/management of invasive species; wildlife and fishery management; nutrient budgeting; shoreland protection; critical habitat protection; water quality protection.

#### **Watershed Recommendations**

- Since computer modeling results suggest that input of nutrients, especially phosphorus, are a factor that needs to be explored for Friendship Lake, it is recommended that both the surface and ground watersheds be inventoried, documenting any of the following: runoff from any livestock operations that may be entering the surface water; soil erosion sites; agricultural producers not complying with nutrient management plans and/or irrigation water management plans.
- If such sites are documented, the Friendship Lake District should encourage landowners & the Adams County Land & Water Conservation Department to design and implement practices to address site issues.

### **Water Quality Recommendations**

- All lake residents should practice best management on their lake properties, including keeping septic systems maintained in proper condition and pumped every three years, eliminating the use of lawn fertilizers, cleaning up pet wastes and not composting near the water.
- Reducing the amount of impervious surface around the lake and management of stormwater runoff will also help maintain water quality.
- Residents should become involved in the Citizen Lake Water Monitoring Program. This includes water quality monitoring, invasive species monitoring and the Clean Boats, Clean Waters program.
- Lake residents should protect and restore natural shoreline around Friendship Lake. Studies have found that shore disturbance can negatively impact the aquatic plant community and water quality of a lake.

- Shores with inadequate buffers need to restore the buffers to an adequate condition to provide shore stabilization, as well to assist in maintaining water quality.
- A stormwater management plan should be developed to manage runoff from the increased amount of impervious surface around the lake.

#### **Aquatic Plant Recommendations**

- All lake users should protect the aquatic plant community in Friendship Lake by assisting in developing and implementing an integrated aquatic plant management plan that uses multiple methods of control.
- The Friendship Lake District should maintain exotic species signs at the boat landings and contact DNR if the signs are missing or damaged.
- The Friendship Lake District should continue monitoring and control of invasives aquatic plants to maintain the most effective methods and modify if necessary. The Lake District should investigate ways to increase treatment effectiveness in the deeper water, since EWM occurs in waters over 10' on the lake. Residents may need to hand-pull scattered plants.
- Mechanical harvesting should use target harvesting to deal with the EWM and CLP control, as well as avoiding sensitive areas and water lily beds.
- Lake residents should get involved in the county-sponsored Citizen Aquatic Invasive Species Monitoring Program. This will allow not only noting changes in the Eurasian Watermilfoil pattern, but also those for Curly-Leaf Pondweed and Purple Loosestrife. Noting the presence and density of these plants early is the best way to take preventive action to keep them from becoming a bigger problem.
- Shores with inadequate buffers need to restore the buffers to an adequate condition to provide shore stabilization, as well to assist in maintaining water quality.
- A plan to reduce plant cover in some areas of the lake—where aquatic plant growth is especially dense—should be developed to reduce the excessive vegetation (for fish use) currently.
- No chemicals, including lawn fertilizers, should be used on properties around the lake.
- Fallen trees should be left at the shorelines/in the water for habitat.

### **Critical Habitat Recommendations**

- Maintain current habitat for fish and wildlife.
- Leave fallen trees along shoreline & in water.
- Seasonal protection of spawning habitat. No alteration of littoral zone except for WDNR-approved projects.

- Maintain the wildlife corridor.
- Maintain snag/cavity trees for nesting.
- Maintain sedge meadow/deep marshes areas.
- Protect emergent vegetation, which not only provides habitat, but also helps dampen wave action, thus assisting in reducing erosion.
- Seasonal control of exotics.
- No bank grading or grading of adjacent land. Disturbance of shore area should be minimal, only allowing for the 30' of every 100' of shore, or 30% of less than 100', for view/access corridor.
- Maintain aquatic vegetation in undisturbed condition for wildlife habitat, fish use and water quality protection.
- Revise lake management plan to provide protection for those areas designated as critical habitat areas.
- No installation of sand or pea gravel blankets.
- Any additional pier installation should use light-penetrating material only.